IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

Penn Engineering & Manufacturing Corp.	:	
Plaintiff,	:	
v.	:	No.: 2:19-CV-00513-GEKP
Peninsula Components, Inc.,	:	
Defendant.	:	

<u>DECLARATION OF BRIAN BENTRIM</u>

I, Brian Bentrim, declare as follows:

1. I am the Vice President of Global Process Innovation for PennEngineering. I have been employed with PennEngineering since 1996. While employed I have worked in manufacturing engineering (production techniques), applications engineering (pairing product attributes to customer needs), new product development (fastener R&D), quality, PEMSERTER engineering (engineering the presses that install our product), and Process Innovation (revolutionizing our manufacturing technologies). This has given me a broad understanding of the fasteners, fastener design, production technologies, customer base, installation equipment, testing and measurement, quality controls and management functions within PennEngineering.

2. I hold a Bachelor of Science in Mechanical Engineering from Lafayette College (1996), a Masters of Engineering – Mechanical Engineering from University Lehigh (2003), and a Masters of Business Administration from Villanova University (2019).

3. Innovation and development of new products has always been a hallmark of PennEngineering. Since 1942, PennEngineering has been constantly inventing and improving its fastener products and makes significant investments each year for the design, development,

testing, and certification of new fastener products. For instance, PennEngineering plans to invest about $2,200,000 this year. For example, Exhibits 28-35 show seven new products that have been design, developed and brought to market over the past 6 years. As the result of its commitment to research and development, PennEngineering has been issued more than 150 U.S. and foreign patents for fastener products, fastener installation equipment, and fastener manufacturing methods.

4. In the fastener solutions industry, name and reputation are critical to a company's continued success. PennEngineering's name and reputation are its most valuable assets. Over the past 80 years, PennEngineering has developed a reputation for designing, manufacturing and selling only the highest quality fastener products. PennEngineering exercises extensive quality control at its manufacturing plants and has a manufacturing strategy of defect prevention rather than defect detection. PennEngineering uses statistical tools throughout its manufacturing processes to monitor the performance and assure effective quality control of each process step. If a non-conforming situation arises, it is resolved immediately with the use of appropriate quality assurance tools.

5. Self-clinching fasteners are specifically designed to be clinched to thin sheets of metal, such as aluminum or stainless steel, and are used in a wide variety of industrial applications, each of which requires different performance properties. "Clinching" is the process of exerting force to deform the host material with the fastener to lock the fastener permanently to the host material; the fastener moves the host metal into crevices and grooves on the fastener to lock the two together. Therefore, the structural and performance properties of PEM's fasteners must be identified to professionals who intend to specify them for a particular product. For

example, PennEngineering publishes performance data for the following performance properties of its fasteners:

A. the force required to install the fastener into the metal sheet (“Installation” force)
B. the force required to push a fastener out of the metal sheet (“Push-Out” force)
C. the force required to pull a fastener thru the metal sheet (“Pull-Thru” force) [carriage return added]
D. the force required to twist or torque a fastener out of the metal sheet (“Torque-Out” force);the maximum tightening force on a nut; and,
E. the minimum distance the mounting hole must be positioned from the edge of the metal sheet (“Min Hole Distance”).

This data is collectively referred to as the Performance Data. PennEngineering publishes its Performance Data in its digital and printed product brochures, which are publicly distributed to both current and prospective customers. Sample performance tables from Defendant’s NA/NAL online product brochure (Exhibit 2) are shown below:

PERFORMANCE DATA(1)(2)

AC/AS/LAC/LAS NUTS

	Thread Code	Shank Code	Test Sheet Material					
			5052-H34 Aluminum			Cold-Rolled Steel		
			Installation (lbs.)	Retainer Pushout (lbs.)	Retainer Torque-out (in. lbs.)	Installation (lbs.)	Retainer Pushout (lbs.)	Retainer Torque-out (in. lbs.)
UNIFIED	440	1	1500	215	65	3000	300	85
		2	2000	225	80			150
	632	1	2000	240	140	3000	300	150
		2		250	150			175
	832	1	2000	250	140	3000	300	150
		2		265	150		400	200
	032	1	2000	300	150	3500	400	150
		2		350	175		450	200
	0420 0428	2	3000	400	325	5000	500	325

	Thread Code	Shank Code	Test Sheet Material					
			5052-H34 Aluminum			Cold-Rolled Steel		
			Installation (kN)	Retainer Pushout (N)	Retainer Torque-out (N-m)	Installation (kN)	Retainer Pushout (N)	Retainer Torque-out (N-m)
METRIC	M3	1	6.7	956	7.3	13.3	1334	9.6
		2	8.9	1000	9	13.3	1334	16.9
	M4	1	8.9	1112	15.8	13.3	1334	16.9
		2	8.9	1178	16.9	13.3	1779	22.6
	M5	1	8.9	1334	16.9	15.6	1779	16.9
		2	8.9	1556	19.7	15.6	2001	22.6
	M6	2	13.3	1779	36.7	22.2	2224	36.7

A4/LA4 (3) NUTS

	Thread Code	Test Sheet Material		
		300 Series Stainless Steel		
		Installation (lbs.)	Retainer Pushout (lbs.)	Retainer Torque-out (in. lbs.)
UNIFIED	440	9000	200	85
	632	10000	200	85
	832	12000	200	85
	032	13000	250	125

	Thread Code	Test Sheet Material		
		300 Series Stainless Steel		
		Installation (kN)	Retainer Pushout (N)	Retainer Torque-out (N-m)
METRIC	M3	40	890	9.6
	M4	53	890	9.6
	M5	57	1100	14.1

(3) Specifically designed for installation into stainless steel.

6. PennEngineering’s Performance data was generated at great expense and effort over the past 80 years. Each value is generated by testing multiple samples of each size of each

fasteners (Unified and Metric) according to written Fastener Test Specifications ("FTS") developed by PennEngineering. Sample FTSs are attached as exhibit 43. Testing is performed on a production lot, using production equipment and production personnel. These FTS's were used by PennEngineering's expert, Carmen Vertullo, and Defendant's expert, Lee Swanger, when they prepared their testing reports. In general, each PennEngineering FTS describes: the particular performance property to be tested; the tooling and equipment needed to conduct the test; and, the specific test method steps. More specifically, the PennEngineering FTSs also include: illustrations, pictures and size charts for the necessary tooling; illustrations of force applications; and step-by-step procedures for performing each test.

7. After multiple fasteners are tested, PennEngineering performs a statistical analysis of the data and publishes performance values that are based on the statistical minimum results; the data is published as an average however, the published values are not averages. Instead, PennEngineering conservatively publishes a value much lower than the average to account for normal production variations. The published value represents the minimum allowable value. The testing also takes into account worst case manufacturing and installation conditions. The actual value published by PennEngineering is calculated using the following formula: Ppublished = 80% x (Paverage- 3σ) where P is the performance value and σ is the standard deviation of the test data for the samples. The rational for this formula is explained below.

8. Sample calculations for three PEM pins is shown in Exhibit 78. In one example for the MPP-1mm pin, the average Push-Out Force was 581 N and the standard deviation was 60 N. As a result, the Pushout-Force published in PennEngineering's catalogs for this fastener was only 320 N. In a normal distribution, Paverage - 3σ represents that 99.7% of the parts will have a Push-Out Force higher than this value. However, due to historic variation in production (lot-

to-lot) variation, PennEngineering reduces the Paverage - 3σ value by 20% to account for worst possible lot-to-lot variation. In this example, Ppublished = 0.8 x (581 – 180).

9. True mathematical averages are not published because engineers assume/believe that each fastener sold by PennEngineering will possess the published structural and performance value shown in the charts. Despite any disclaimer, engineers rely on the published performance value, in combination with a factor of safety, to design their products and specify a particular component on the manufacturing prints. For example, if an engineer is designing a product that requires a self-clinching pin having 500 N of pushout force, the engineer references PennEngineering's performance catalogs and selects a pin having a reported pushout force of at least 500N. The engineer expects that every pin supplied by PEM will have at least 500N of pushout force. The engineer can't rely on a pin having a published average performance value of 500N because statistically many of the pins will have less than 500N of pushout resistance, which is unacceptable under generally-accepted engineering principles. More importantly, the engineer does not know how far below (or above) the average some of the pins may be. For example, the average of 440, 450, 500, 550 and 560 is 500. In that example, some of the pins may have pushout resistance as low as 400N, which may cause the end-product to fail.

10. The information contained in every PennEngineering performance table is generated by testing each unique part material and geometry identified therein, not by estimation or experimental extrapolation. For example, it does not test certain sizes within a series of fasteners, and then use statistical extrapolation to estimate the performance properties of un-tested parts. Every size of every series of fasteners is tested. Parts with identical materials, clinch-geometries, and manufacturing process are grouped for testing (for example: SO-632, BSO-632, SO-6440, and BSO-6440 parts of all lengths are grouped with one test set).

11. The cost for testing and establishing catalog performance values for a new part depends on several factors. For example, some properties, such as Torque-Out, are not relevant to some parts since those parts are not subject to torque-out forces during normal use. Moreover, the numbers of sizes varies for different parts. However, the average cost to test and generate a performance table for a new product is about $14,000. This conservative estimate is based on the following assumptions:

a. Each table has only 8 unique part geometries (four unified and four metric);
b. The fastener is made from 2 different materials (steel and stainless);
c. The fastener is tested for installation into 2 different materials (steel and aluminum); and,
d. The chart includes three tests (pushout, torque-out and pull-thru/tensile) – installation force comes out through the tests.

Based on these assumptions, PennEngineering must perform 96 (8x2x2x3) test programs for each table.

12. Each program tests 30 parts and involves the following steps for an experienced technician:

a. Collect panels and measure thickness (about 4 per program) – 5 minutes
b. Test panel hardness (one each panel) – 5 minutes
c. Prepare holes (30 holes) – 10 minutes
d. Install fasteners (30 installs) – 10 minutes
e. Perform testing (30 tests) – 90 minutes
f. Log results – 10 minutes

Thus, the combined time for each of these steps is about 130 minutes (5 + 5 + 10 + 10 + 90 + 10). When multiplied by the total number of 96 test programs, the total time creating a performance table is about 12,480 minutes or 208 hours (about 5 solid weeks of work).

13. Afterwards an engineer will review the work, apply the statistics, question items, etc… This will take about 8 hours. Assuming that all looks good on the first pass, the data will

be compiled into a table in coordination with the marketing team. This will take about 7 hours (one hour of discussion of 3 people, four hours of work). Totaling the hours by estimated rates:

208 hours of Technician at a rate of $60/hr = $12,480
15 hours of Engineer/Marketing at $140/hr = $2,100.

This results in a grand total of about $14,580.

14. PennEngineering's fasteners are also periodically tested to ensure they comply with published structural and performance properties. Once the manufacturing process has been established, each production lot is certified for plating and material conformance only. If a customer requests performance certification with its order, PennEngineering will perform that testing and provide a performance certification. However, unless requested by the customer samples from each production lot are tested only in audit situations and periodic validation runs.

15. As a result of its routine testing, design or manufacturing modifications, discovery of publication errors, etc, PennEngineering periodically revises the data in its published tables to ensure those tables convey the most accurate and up-to-date information. For example, since 2013, PennEngineering has made at least the changes identified in Exhibit 44.

16. PennEngineering's manufacturing drawings and manufacturing processes are closely-guarded trade secrets. PennEngineering does not disclose these drawings or manufacturing processes to the public, and especially not to competitors. The limited dimensions published in our sales drawings are the minimum need by our customers to identify and select the appropriate size fastener for its particular application. Many of the critical dimensions for manufacturing these parts are not shown in our sales drawings. Therefore, our competitors do not know all of the critical dimensions and tolerances of our fasteners, or the specific details how PennEngineering makes its fasteners.

I declare under penalty of perjury that the foregoing is true and correct.

Brian G Bent...

Date: January 6, 2022

Brian Bentrim